EMBRYOLOGY.[1]

Germ-layers of Vertebrates.[2]—Basilius Lwoff has extended his work upon the germ-layers of Amphioxus[3] to other vertebrates and put forth a preliminary paper that arouses in us a lively interest in the final detailed account that is to contain both his own discoveries and a discussion of the literature of the subject.

In the present paper he makes statements directly contrary to some opinions that up to the present time we have supposed to be well-founded in fact.

Besides Amphioxus, he has studied the formation of the germ-layers in Petromyzon, the Axolotl, Pristiurus, Torpedo, Labrax, Julis, Gobius, and Lacerta. He regards the Chordata as derived from a gastrula-like ancestor. Gastrulation is defined as the process by which the gut is formed, and the entoblastic cells are those which form the gut, whatever else they may produce. In Amphioxus and Vertebrates with holoblastic eggs, cleavage results in a blastula, one-half of which is composed of micromeres, the other of macromeres. Owing to the continued more rapid multiplication of the micromeres, they cover and grow around the macromeres. When the blastula is single layered, as in Amphioxus, this results in the invagination of the macromeres, where it is several layered, as in Petromyzon and the Amphibia, they are simply surrounded by the micromeres.

The macromeres form the gut and are therefore entoblast, while the micromeres form the outer covering and are therefore ectoblast. But there can be no distinction between entoblast and ectoblast until the micromeres have surrounded the macromeres. Besides this process of gastrulation there is a *dorsal invagination* that has nothing to do with the formation of the gut, but forms the whole ectoblastic rudiment of the chorda and the mesoblast.

The blastula of Petromyzon contains an extensive cleavage cavity, the roof of which is composed of micromeres and the floor of macromeres. The former multiplying more rapidly, grow around the latter. At the same time a new cavity is sunk into one side of the embryo, the roof being formed of invaginated ectoblast, while the floor is com-

[1] This department is edited by E. A. Andrews, Johns Hopkins University.

[2] Biol. Centblt. 13, 1893, 40–50, 76–81.

[3] See AMERICAN NATURALIST, March, 1893, p. 228.

posed of entoblast that has not been invaginated. As in Amphioxus, this invaginated ectoblast forms the chorda and part of the mesoblast, while the entoblast forms the rest of the mesoblast as well as the gut.

Nearly the same process, according to Lwoff, takes place in the Axolotls. But here the dorsal invagination begins, while the micromeres are growing over the macromeres, and the ectoblastic rudiments of the mesoblast never form part of the roof of the enteric cavity. In the frog, however, Morgan[4] and Robinson and Assheton[5] seem to have found good evidence that the micromeres do not grow around the macromeres, but that the superficial ones of the latter are themselves gradually split up into micromeres, so if we are to accept Lwoff's interpretation of the dorsal invagination, the gastrulation in this form may better be described as being by delamination than by an epibolic process. Moreover, according to the apparantly accurate work of Robinson and Assheton, there is no invagination of the ectoblast in the frog.

In Selachians and Teleosts, Lwoff believes the entire entoblast arises from the yolk-elements, that is, the periblast. This is surprising in view of the many statements to the contrary, especially H. V. Wilson's[6] work on the sea-bass. Lwoff finds the chorda and part of the mesoblast to be formed from the same elements as the nervous system. The entoblast also takes part in the formation of the mesoblast.

In Lacerta, cleavage results in a two layered germinal disc. The inner layer becomes the entoblast. An invagination from the outer layer forms the chorda and part of the axial mesoblast. The rest of the axial and the peripheral mesoblast is of entoblastic origin.

The process in the formation of the germ layers throughout the Vertebrates is practically the same as in Amphioxus, except that there is no invagination to form the entoblast, and there are, therefore, no gastrula lips. There is but one point in the embryo that is homologous in all Vertebrates, and that is the point where the ectoblastic invagination begins. The so-called neurenteric canal does not lie between the neural canal and the archenteron, but between the former and the chorda, and shows their intimate connection—R. P. B.

The Mantle of Ascidians.—In studying live specimens of larval Phallusia, A. Kowalevsky[7] at first thought with Hertwig, Sem-

[4] AMER. NAT., Aug., 1891, p. 753.

[5] Quart. Jour. Mis. Sci., 32, 1891, p. 451.

[6] Bul. U. S. Fish. Com., 9, 1891, p. 209.

[7] Mem. l'Acad. Imp. Sci. St. Petersburg, 7, 37, No. 10, 1892.

per, Maurice and others, that the mantle of this ascidian should be regarded as an epidermis-like structure, a thickening of the ectoderm with large amounts of intercellular material between the ectodermal cells.

On studying sections of this larva, however, he obtained evidence that mesodermal cells migrate out through the epidermis of the larva into the thick hyalin cuticle or secreted mantle matrix, and thus supply mesodermal cells as the fundamental cells of the mantle.

These migrating cells the author would regard as a sort of phagocytes and imagine to have a primary function in destroying the injurious parasites, bacteria, etc., that would easily lodge in the secreted mantle matrix.

In the same paper there is an interesting account of the degenerative changes that the tail of the larva undergoes when free life is given up. After peculiar histological transformations in the notachord and muscles of the tail, these cells and the epidermal cells pass into the body. The last of the tail is drawn in by an actual hollow invagination that forms a closed vesicle in the body. The ultimate changes in the muscle cells are accompanied by the activity of clusters of phagocyte-like mesoderm cells.